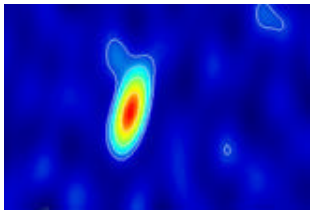


New Clues to Nature's Greatest Explosions

By Robert Roy Britt
Senior Science Writer
posted: 04:30 pm ET
28 May 2003

NASHVILLE -- For decades researchers have searched for the cause of incredible explosions from deep space called gamma ray bursts. Investigations into two such recent events have managed to rule out one theoretical model and provide support for another, while also hinting at the mechanism behind the bursts.

Gamma ray bursts (GRBs) shine briefly with the intensity of a million trillion suns. One or two a day go off, scattered throughout the cosmos.

GRBs are almost surely caused by supernovae, explosive collapses of the most massive stars, which end up forming black holes or dense neutron stars. A beam of energy shoots out along the axis of the star's rotation, theory holds. If that beam is aimed at Earth then a GRB can be recorded.

But the specific mechanism for triggering the immense release of energy is not known.

Chasing the elusive

GRBs are elusive, some lasting less than a second. And though intense, they typically originate billions of light-years away, so the amount of energy that reaches our solar system is relatively limited. The two events in question, however, were bright enough and caught quickly enough to be well studied.

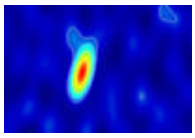
On March 29, the closest known gamma ray burst -- 2.6 billion light-years away -- was spotted by NASA's High-Energy Transient Explorer satellite (HETE).

Subsequent observations of GRB 030329, as it's called, are the most detailed ever made of a GRB and its so-called afterglow, radiation that continues to pour out in other wavelengths, from radio waves to visible light and X-rays.

Data from the National Science Foundation's Very Long Baseline Array and other telescopes show that matter streamed from the collapsing star at about 98 percent of the speed of light in a smooth, rather orderly manner many days after the initial eruption, explained Dale Frail of the National Radio Astronomy Observatory.

This supports the leading model for GRBs, known as the fireball model, which supposes a continuous stream of matter and energy racing outward. It refutes another theory, known as the cannonball model, which held that Earth-mass blobs of material were shot out.

Images



At a distance of about 2.6 billion light-years, GRB 030329 is hardly next door. However, compared to other GRBs at typical distances of 8-10 billion light-years, it presents an easier target for study. CREDIT: NRAO/AUI/NSF

More Stories

- 202nd Meeting of the American Astronomical Society
- Supernova Factory Discovered Where Galaxies Collide
- New Evidence for a Stop-and-Go Universe
- Strangest Star Known is the 'Talk of Astronomy'
- Mystery Object is Student's Discovery of a Lifetime

"We're not ready to concede victory," Frail joked, adding that more data has been collected and needs to be analyzed. "But I think we've clearly ruled out the alternative [cannonball] model."

(After March 29, the cannonball theory's creators claimed to predict subsequent phenomena that should be observable, and they were right. Frail said, however, that the fireball model could have been used to make similar prediction. Frail said the cannonball was a viable model until now.)

Garnering support

Other researchers agreed with Frail's assessment.

Steven Boggs of the University of California, Berkeley, led observations of an earlier gamma ray burst that shed additional light on the source of the eruption.

That event, December 6, was monitored by the RHESSI satellite, which detected polarization in the radiation of the beamed jet ejected by the burst.

Photons of all light are polarized, either sideways or up-and-down, Boggs explained. His team looked at the average polarization of all the radiation -- whether it tended to be more of one type or the other. The light was polarized about 80 percent in one direction.

Boggs explained that the polarization of the light provided clues to the geometry of the source that generated it. Large and strong magnetic field lines appear to have been wound up, much like strings on a top, then were spat out as the star collapsed, "probably beamed in our direction."

Both findings were presented here today at a meeting of the American of the American Astronomical Society.

Chryssa Kouveliotou of NASA's Marshall Space Flight Center is a 30-year veteran of gamma ray burst research, but was not involved directly in the new studies. She called Boggs' results a milestone, and, by that measure said Frail's conclusions were a "kilometer-stone." A kilometer is about six-tenths of a mile.

Frail's results "show that the fireball model is alive and well and that all of the competing models are dead," Kouveliotou said.

She said it's still unclear how much total energy a GRB puts out. And there is another, larger question that remains: "What is the beast in the center?"

- **More Deep Space News**
- **Space Photo Galleries & Wallpaper**
- **Astronotes**

SPACE.com TOP STORIES

- Planet Puzzle: The Mystery of the Disappearing Disks
- New Image Gallery: Hurricanes!
- On the Edge: The Future of Fuel Cells
- International Space Station: On the Trail of Lewis and Clark
- Soyuz Rocket Boosts Mars Express Toward Red Planet
- Catch the Wave: Asteroid-driven Tsunami in U.S. Eastern Seaboard's Future
- U.S., European Negotiators Hopeful About Galileo Deal
- SPACE.com: More News Headlines
- Stars and Symbolism: Flags Inspired by the Night Sky
- Japan Recovers Capsule That Carried Made-In-Space Product